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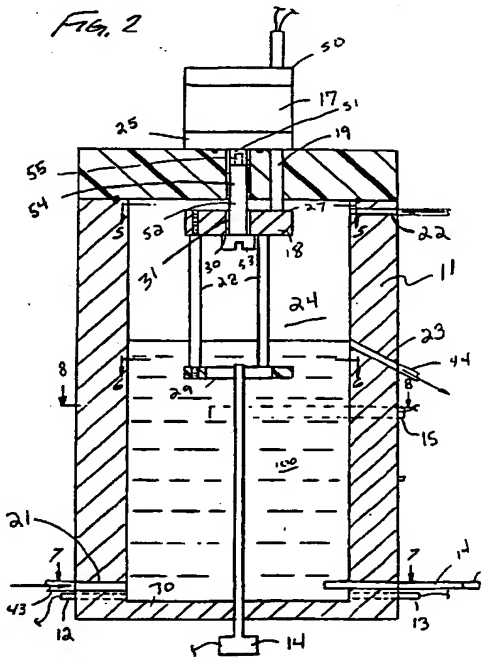
(54) Cloud point and pour point analyser

(57) There is disclosed in preferred embodiments an apparatus and a method for automatic determination of cloud point temperature and pour point temperature of a petroleum fraction. The apparatus is comprised of a receptacle (11) for holding a sample of the petroleum fraction, a light source (12), a light detector (13), heaters (15), coolers (16) and a proximity sensor combined with a motion indicator to determine cloud and pour point temperature. The apparatus preferably has thermocouples to determine the temperature of samples within the container as the sample is heated and cooled. Measurements of light refraction are used to determine cloud point temperature. Detection of the freezing in place of a motion indicator is used to determine pour point temperature. The apparatus is particularly useful for determining the cloud point and pour point temperatures of middle distillate petroleum fuels and the pour point temperature of dark oils and for determining the amount of pour point depressant needed to achieve desired cloud and pour point temperatures in a fuel.



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Description

FIELD OF THE INVENTION

The present invention relates to determination of cloud and pour point temperatures of a hydrocarbon. More particularly, the present invention relates to an apparatus and a method for automatically determining the cloud and pour point temperatures of a petroleum fraction containing dissolved wax.

BACKGROUND OF THE INVENTION

Some petroleum fractions, particularly middle distillate petroleum fuels and dark oils typically contain varying quantities of dissolved wax. Waxes are hydrocarbons of high molecular weight which are solids at about 70°F or less such as paraffin and microcrystalline. Wax has a tendency to crystallize within a petroleum fraction as the petroleum fraction temperature decreases. Crystallized wax causes the petroleum fraction to cloud, become viscous and, as the temperature drops, to solidify. A particular problem exists during the winter months when wax crystallization caused by low outdoor temperatures can cause fuel lines, filters and the like to clog in diesel engines and furnaces which burn petroleum fractions.

Pour point depressants such as kerosene and polymerized higher esters of acrylic acid derivatives are well known in the art. When added to a petroleum fraction, pour point depressants lower the cloud point and the pour point temperature of the petroleum fraction. Kerosene is also used as a diluent to lower the cloud point of petroleum fractions. However, wax content within a petroleum fraction often varies with the distillation conditions under which the fraction was produced and with the source of crude oil from which the fraction was distilled. Thus, the amount of pour point depressant needed to achieve a desired pour point in a petroleum fraction will vary.

Standard tests have been developed by the American Society for Testing and Materials (ASTM) to determine cloud and pour point temperatures. The cloud point temperature test, ASTM D2300-91, determines the temperature at which a cloud of wax crystals will form in a volume of petroleum product. The pour point temperature test ASTM D97-87 determines the lowest temperature at which a petroleum product will flow. Both ASTM D2500-91 and D97-87 are manual tests which require hands on manipulation of petroleum product samples to determine cloud and pour point temperatures.

To account for weather extremes, it is generally desirable to utilize fuels (petroleum fractions) having pour points at least about 10-15°F below the anticipated operating temperature of a fuel. To depress the cloud and pour point temperatures of fuels to a desired temperature it is common practice to remove a sample of fuel from a refinery production stream, add a pour point depressant to the fuel sample, conduct ASTM's D97-87 and D2500-91 to determine the pour point depressant's effect on the sample and to repeat these steps until addition of pour point depressant results in desired cloud and pour point temperatures in the sample. A proportional amount of pour point depressant is then injected into the process stream to lower the pour point of the fuel before it is shipped for use. Since ASTM's D97-87 and D2500-91 are manual tests this process is very time consuming.

Attempts have been made to eliminate the manual determination of cloud and pour point temperatures. An apparatus utilizing a microprocessor controlled photocell is available commercially from Precision Scientific, Inc. of Chicago, Illinois, which determines the cloud point temperature of a material. A separate apparatus utilizing air pressure pulses to determine pour point temperature is also available commercially from Precision Scientific, Inc. Alcor Engineering manufactures a pour point tester utilizing a weighted ring which is visually monitored for cessation of movement by the tester user to determine the pour point temperature of a material. However, a single unitary apparatus is not currently available to determine both cloud and pour point temperatures of a material.

Therefore, a need exists for an apparatus and a method for using the apparatus to automatically determining cloud and pour point temperatures of petroleum fractions. A need also exists for an apparatus which can be utilized on line with an automatic chemical feed system to depress the cloud and pour point temperatures of petroleum fractions as they are processed.

In accordance with the present invention, as embodied and broadly described herein, one characterization of the present invention comprises an apparatus for automatic, determination of the cloud point temperature and the pour point temperature of a petroleum fraction. The apparatus is comprised of a receptacle having a chamber for holding a petroleum fraction sample; a light emitting means attached to the receptacle and positioned to emit light into the chamber; a light detecting means attached to the receptacle and positioned to detect light emitted into the chamber by the light emitting means; temperature measuring means attached to the receptacle for measuring the temperature of the sample within the receptacle chamber; heating means in thermal contact with the receptacle; cooling means in thermal contact with the receptacle; motion producing means attached to the receptacle; motion indicating means attached to said motion producing means; a motion detecting means positioned adjacent the motion indicating means and a programmable logic controller in electrical communication with the light detecting means, the temperature measuring means, the heating means, the cooling means, the motion producing means and the motion detecting means. The programmable logic controller controls heating, incremental cooling and testing of the petroleum fraction sample to determine

the cloud and pour point temperatures of the petroleum fraction.

The method of the invention comprises incrementally cooling the petroleum fraction sample and emitting light into the sample to determine the cloud point temperature of the sample as indicated by light lost to refraction due to wax crystallization. The pour point temperature of a petroleum fraction sample is determined by incrementally cooling the sample and using a movement indicator and motion detecting means to detect that the sample has solidified.

By use of the present invention one or more of the following may be achieved:-

(i) an apparatus and a method of using the apparatus to automatically determine both cloud and pour point temperatures of a petroleum fraction.
(ii) an apparatus which can be installed on-line with a petroleum fraction production stream to automatically determine cloud and pour point temperatures of a petroleum fraction taken from the production stream.
(iii) an apparatus and a method of using the apparatus to automatically depress the cloud and pour point temperatures of a petroleum fraction to temperatures less than or equal to predetermined temperatures.

The invention will now be further described by way of example with reference to the accompanying drawings, which are incorporated in and form a part of the specification, illustrate the embodiments of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings:

Figure 1 is a perspective view depicting the cloud point temperature and pour point temperature analyzer apparatus of the present invention;

Figure 2 is a sectional view depicting the receptacle of the present invention;

Figure 3 is a partially cut-away sectional view depicting the motion indicating means;

Figure 4 is a partially cut-away sectional view depicting the motion indicating means;

Figure 5 is a cross-sectional view taken along lines 5-5 of Figure 2;

Figure 6 is a cross-sectional view taken along lines 6-6 of Figure 2;

Figure 7 is a cross-sectional view taken along lines 7-7 of Figure 2; and

Figure 8 is a cross-sectional view taken along lines 8-8 of Figure 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An automatic cloud point temperature and pour point temperature analyzer apparatus is shown generally as 10 in Figure 1.

The apparatus is comprised of a receptacle 11, a light emitting means 12, a light detecting means 13 temperature measuring means 14, heating means 15, a motion producing means 17, a motion indicating means 18, a motion detecting means 19 as shown in Figure 2, cooling means 16 shown in Figures 7 and 8 and a programmable logic controller 20 shown in Figure 1.

Receptacle 11 is constructed of thermally conductive material such as aluminum, stainless steel, ceramic or the like, having a sample inlet port 21, a gas purge port 22 and a sample outlet port 23 as shown in Figure 2.

Light emitting means 12 is preferably an optical fiber light source which emits light into chamber 24 of receptacle 11. Light detecting means 13 detects light within chamber 24 which is emitted from light emitting means 12 and which is transmitted through a petroleum fraction sample 100. Both light emitting means 12 and light detecting means 13 are electrically connected to programmable logic controller 20 which controls when emitting means 12 emits light and electronically records and stores the amount of light detected by detecting means 13. Light emitting and detecting means of this type are available commercially from Omron of Schaumburg, Illinois. Programmable logic controllers of this type are available from Texas Instruments/Siemans of Johnson City, Tennessee.

Temperature measuring means 14 are preferably a plurality of dual thermocouples as are well known in the art shown in Figures 2, 7 and 8, which measure the temperature of sample 100. Temperature measuring means 14 are electronically connected to programmable logic controller 20 which electronically records and stores the temperature of a sample 100.

Heating means 15 are preferably a plurality of heating rods, having a ceramic core wrapped by a heating wire as are well known in the art, positioned as shown in Figures 2 and 8. Cooling means 16 are preferably a plurality of liquid cooled, solid state cold plates attached to the sides of receptacle 13 as shown in Figures 7 and 8. The cold plates are generally comprised of a front plate 70 in thermal contact with receptacle 11, a thermoelectric module layer 71 and a liquid cooled back plate 72. Cold plates of this type are available commercially from Thermoelectric Cooling American Corp., Chicago, Illinois. Both heating means 15 and cooling means 16 are electrically connected to programmable logic controller 20 which controls actuation of the heating and cooling means.

Motion producing means 17 is preferably an air actuated cylinder having a body 50 and a piston 51, such as available from Bimba Manufacturing of Monee, Illinois. Shaft 52 has a head portion 53, a mid-portion 54

and an attachment portion 55 attached to piston 51 as shown in Figure 2. Motion producing means 17 is attachable to a pressurized air source (not shown) which actuates piston 51. Programmable Logic Controller 20 actuates the pressurized air source and thus controls actuation of motion producing means 17.

Motion indicator means is a means which indicates when a sample of fuel has solidified by ceasing motion. Motion indicator means 18 is preferably comprised of a top member 27, slideably attached to shaft 52 at orifice 31, and attached to a plurality of legs 28 which attach top member 27 to bottom member 29. Bottom member 29 is preferably a flat ring as shown in Figures 6.

Motion detecting means 19 is preferably a proximity sensor as is well known in the art which is electronically connected to programmable logic controller 20 which records and stores whether or not top member 27 of motion indicator means 18 is in proximity to motion detecting means 19.

Receptacle 11 is enclosed by a housing 30 as shown in Figure 1. Housing 30 provides a convenient cabinet for storage, and protection from the environment for the apparatus components. As shown in Figure 1, housing 30 includes an enclosure protection system 200 which reduces the hazardous area rating within the enclosure to a non-hazardous rating by maintaining positive air pressure within housing 30 to prevent intrusion of explosive vapor into housing 30. Enclosure protection systems are available commercially from Bebco Industries of Texas City, Texas. Hydroscopic dryer 40 is attached to housing 30 and is in fluid communication with a petroleum fraction source (not shown) at inlet 41 and in fluid communication with receptacle 11 at sample inlet duct 43 and sample outlet duct 44. Hydroscopic dryer 40 is preferably a dryer which utilizes a salt such as sodium chloride or potassium chloride to remove trace water from the fuel sample prior to sample cloud and pour point determination. Sample outlet duct 44 is also in fluid communication with the petroleum fraction source (not shown). The petroleum fraction source is preferably a petroleum fraction processing stream.

Apparatus 10 determines cloud point temperature by incrementally cooling a petroleum fraction sample and using light refraction to indicate crystal formation. Pour point temperature is determined by incrementally lowering a samples temperature until a motion indicator becomes frozen within the solidified sample. To utilize apparatus 11 a petroleum fraction sample 100 is removed from a source such as a petroleum fraction processing stream and is injected into inlet 41. Fuel sample 100 is passed through hydroscopic dryer 40 to remove any trace water from the sample which may interfere with cloud point or pour point temperature determination and is injected into receptacle 11 via duct 43 shown in Figure 1 which is connected to inlet 21 shown in Figure 2. Sufficient sample 100 is added to chamber 24 of receptacle 11 to submerge bottom member 29 of indicating means 18 as shown in Figure 2. The cloud and pour point temperatures of sample 100 are determined by:

a) heating sample 100 to at least 115°F by energizing heating means 15;

b) emitting light into chamber 24 and into sample 100 by energizing light emitting means 12;

c) detecting the light transmitted from emitter 12 through sample 100 by light detecting means 13;

d) cooling sample 100 by deenergizing heating means 15 and activating cooling means 16;

e) emitting light into sample 100 by energizing light emitting means 12;

f) detecting the light transmitted from emitter 12 through sample 100 by light emitting means 13;

g) comparing the amount of light detected in step f) to the amount of light detected in step c) to determine the percent amount of light lost to refraction by wax crystal formation using the equation:

$$\frac{L_c - L_f}{L_c} \times 100 = L_L$$

where: L_c is the amount of light detected in step c,
L_f is the amount of light detected in step f, and
L_L is the percent amount of light lost to refraction;

h) repeating steps d) - g) until L_L is about 2% or greater;

i) when L_L is about 2% or greater, recording the cloud point temperature of sample 100;

j) cooling sample 100 of step i) by at least 5°F;

k) moving motion indicating means 18 by actuating motion producing means 17;

l) detecting the movement of motion indicating means 18 by motion detecting means 19:

m) repeating steps j) - l) until no movement of motion indicating means 18 is detected by motion detecting means 19;

n) recording the pour point temperature of sample 100 of step m).

Steps a) - i) are performed by programmable logic controller 20 to automatically determine the cloud point of sample 100 by determining the temperature at which

enough wax crystals have formed in sample 100 to cause refraction of at least about 2% of the light emitted into sample 100 by light emitting means 12. Light refraction of 2% generally indicates enough wax crystal formation to be seen by the naked eye therefore indicating cloud point temperature. Programmable logic controller can be adjusted to record a cloud point temperature at varied amounts of light lost to refraction depending on the user's needs.

Steps j) - n) are performed by programmable logic controller 20 to automatically determine the pour point of sample 100. At temperatures above the pour point of sample 100, in step k), actuation of motion producing means 17 causes shaft 26 to move from the configuration shown in Figure 2 in which top member 27 rests on shoulder 30 of shaft 52 and in which top member 27 is in proximity of motion detecting means 19, to the configuration shown in Figure 3 in which top member 27 rests on shoulder 30 of shaft 52 and in which top member 27 is not in proximity of motion detecting means 19. In step l), when motion detecting means 19 detects that top member 27 is no longer in proximity, programmable logic controller 20 repeats steps j) - l). When repeated cooling lowers the temperature of sample 100 to the point where wax crystal formation has solidified sample 100, and after motion producing means 17 moves piston 26 and shaft 52, the solidified sample 100 freezes bottom member 29 in place. Top member 27 is then prevented from movement by legs 28 which are attached to bottom member 29. Top member 27 slides along shaft 52 in orifice 31 of member 27 and remains in proximity of motion sensor 19. This configuration is shown in Figure 4. When programmable logic controller 20 recognizes that piston 26 has been moved and that top member 27 is still in proximity to motion sensing means 19 the programmable logic controller records that the pour point temperature of the sample has been reached.

The recorded cloud and pour point temperatures are displayed on display panel 60 shown in Figure 1 which is electrically connected to programmable logic controller 20. Thus, controller 20 automatically heats, incrementally cools and tests sample 100 to determine the cloud point temperature and pour point temperature of sample 100.

ASTM D97-87 requires that the pour point temperature be checked at 5°F intervals. If the frequency is increased, it is possible to obtain a falsely lower pour point temperature due to disturbance of the wax crystal structure caused by movement of the motion indicator within sample 100.

Solidified sample 100 is removed from chamber 24 by:

o) ceasing cooling with cooling means 16 and energizing heating means 15 until sample 100 is pourable, and

p) injecting pressurized gas into chamber 24 through gas purge port 22 and adding fresh fuel into chamber 24 by inlet 21. Steps o) and p) melt and force sample 100 out outlet 23 and out of duct 44 thereby purging the tested sample.

Duct 44 is in fluid communication with the fuel source, thus sample 100 is returned to its source.

If the recorded cloud and pour point temperatures are not low enough for the desired utility of the hydrocarbon, a known amount of cloud and/or pour point depressant can be added to the petroleum fraction source, a fresh sample of depressed petroleum fraction is input into chamber 24 and steps a) - i) are repeated to determine a new cloud point for the depressed sample. Steps a) - i) are repeated until enough cloud point depressant has been added to the petroleum fraction to achieve a desired cloud point temperature. Similarly, a pour point depressant can be added to the petroleum fraction source, a fresh sample of depressed petroleum fraction is added to chamber 24 and steps j) - p) are repeated to determine a new pour point for the depressed sample. Steps j) - p) are repeated until enough pour point depressant has been added to the petroleum fraction to achieve a desired pour point temperature. Controller 20 is preferably utilized with an automatic chemical feed system such as PaceSetter® (U.S. Patent No. 4,897,797) available commercially from Betz Laboratories, Inc. to automatically add the pour point depressant into the petroleum fraction source.

As an alternative to automatically adding pour point depressant to a petroleum fraction source, small quantities of pour point depressant can be added to a petroleum fraction sample and steps a) - m) repeated after each addition of depressant until the desired cloud and pour point depression has been achieved. A proportional amount of pour point depressant is then added to the petroleum fraction source to achieve the desired cloud and/or pour point temperatures.

If the apparatus is utilized to determine the pour point temperature of a dark oil, steps a) - i) can be skipped and steps j) - p) can be used.

Thus the invention provides an apparatus and a method for utilizing the apparatus to automatically determine the cloud point temperature and pour point temperature of a petroleum fraction. The apparatus and method eliminates time consuming, repetitive manual testing and is particularly useful for on-line determination of cloud and pour point temperatures when the apparatus is in fluid communication with a petroleum fraction production stream. The invention also provides an apparatus and a method of using the apparatus to determine the amount of additives which must be added to a petroleum fraction to depress the cloud and/or pour point temperatures of the fraction to desired temperatures.

While this invention has been described with respect to particular embodiments thereof, it is apparent that numerous other forms and modifications of the

invention will be obvious to those skilled in the art. The appended claims and this invention generally should be construed to cover all such obvious forms and modifications which are within the true spirit and scope of the present invention.

Claims

1. An apparatus for automatic determination of the cloud point temperature and the pour point temperature of a petroleum fraction, said apparatus comprising:

   a) a receptacle (11) having a chamber (24) for holding a petroleum fraction sample;
   b) a light emitting means (12) attached to said receptacle (11) and positioned to emit light into said chamber (24);
   c) a light detecting means (13) attached to said receptacle (11) and positioned to detect light emitted into said chamber (24) and emitted through said sample by said light emitting means (12);
   d) temperature measuring means (14) attached to said receptacle (11) for measuring the temperature of said sample inside said chamber (24) of said receptacle (11);
   e) heating means (15) in thermal contact with said receptacle (11) for heating said receptacle (11);
   (f) cooling means (16) in thermal contact with said receptacle (11) for cooling said receptacle (11);
   g) motion producing means (17) attached to said receptacle (11);
   h) a motion indicator means (18) attached to said motion producing means (17);
   i) a motion detecting means (19) positioned adjacent said motion indicator means (18); and
   j) a programmable logic controller (20) in electrical communication with said light emitting (12), said light detecting (13), said temperature measuring (14), said heating (15), said cooling (16), said motion detecting (19) and said motion producing means (17) wherein said programmable logic controller controls heating, and incremental cooling of said petroleum fraction sample and whereby the cloud point and pour point temperatures of said petroleum fraction sample are determined.

2. An apparatus as claimed in claim 1, wherein said receptacle (11) is a thermally conductive vault, having a sample inlet port (21) attachable to a petroleum fraction source, a gas purge port (22) and a liquid outlet port (23).

3. An apparatus as claimed in claim 1 or 2, further comprising a housing (30).

4. An apparatus as claimed in claim 3, wherein said housing (30) includes a means (200) for maintaining a positive air pressure within said housing to protect said housing from intrusion of explosive vapors.

5. An apparatus as claimed in any one of the preceding claims, further comprising a hydroscopic dryer (40) for removing water from liquid samples prior to testing in said apparatus.

6. An apparatus as claimed in any one of the preceding claims, wherein said petroleum fraction source is a petroleum fraction processing stream.

7. An apparatus as claimed in any one of the preceding claims wherein said controller (20) is in electrical communication with an automatic chemical delivery system which adds pour point depressant chemicals into said petroleum fraction process stream.

8. An apparatus as claimed in any one of the preceding claims, wherein said temperature measuring means (14) is a plurality of thermocouples; said heating means (15) are a plurality of heating rods; said cooling means (16) are a plurality of liquid cooled, solid state cold plates; and said light emitting means (12) is an optical fiber light emitter.

9. An apparatus as claimed in any one of the preceding claims, wherein said motion producing means (17) is an air actuated cylinder having a body (50), a piston (51) attached to said body (50) and a shaft (52) attached to said piston (51).

10. An apparatus as claimed in claim 9, wherein said motion indicator means (18) is comprised of a top member (27) slideably attached to said shaft (52) of said motion producing means (17), a plurality of legs (28) attached to said top member (27) and a bottom member (29) attached to said legs (28).

11. An apparatus as claimed in claim 10, wherein said motion detecting means (19) is a proximity sensor for sensing the proximity of said top member (27) of said motion indicating means (18).

12. An apparatus as claimed in any one of the preceding claims, wherein said petroleum fraction sample is a middle distillate fuel or a dark oil.

13. A method of automatically determining the cloud point and pour point temperatures of a petroleum fraction, said method comprising;

    a) heating a petroleum fraction sample in a receptacle (11) having a chamber (24) for hold-

ing said sample to a temperature of at least 115°F;

b) emitting light into said sample in said chamber (11) of step a);

c) detecting the amount of light emitted through said sample of step b);

d) cooling said sample of step c);

e) emitting light into said sample of step d);

f) detecting the amount of light emitted through said sample of step e);

g) comparing the amount of light detected in step f) to the amount of light detected in step c) and determining the percentage amount of light lost to refraction using the equation:

$$\frac{L_c - L_f}{L_c} \times 100 = L_L$$

where: L_c is the amount of light detected in step c,
L_f is the amount of light detected in step f, and
L_L is the percent amount of light lost to refraction;

h) repeating step d) - g) until said percentage amount of light lost to refraction is at least 2%;

i) recording the cloud point temperature of said sample;

j) cooling said sample of step i);

k) moving a motion indicator means, said motion indicator means at least partially submerged in said sample;

l) detecting said movement of said motion indicator means with a motion sensing means;

m) repeating steps j) - l) until no movement is detected; and

n) recording said pour point temperature of said sample.

14. A method for automatically depressing the cloud point temperature of a petroleum fraction to a temperature equal to or less than a predetermined cloud point temperature, said method comprising:

a) removing a petroleum fraction sample from a petroleum fraction source;

b) heating said petroleum fraction sample of step a) in a receptacle (11) having a chamber (24) for holding said sample to a temperature of at least 115°F;

c) emitting light into said sample in said chamber of step b);

d) detecting the amount of light emitted through said sample of step c);

e) cooling said sample of step d);

f) emitting light into said sample of step e);

g) detecting the amount of light emitted through said sample of step f);

h) comparing the amount of light detected in step g) to the amount of light detected in step d) and determining the percentage amount of light lost to refraction using the equation:

$$\frac{L_c - L_f}{L_c} \times 100 = L_L$$

where: L_c is the amount of light detected in step d,
L_f is the amount of light detected in step g, and
L_L is the percent amount of light lost to refraction;

i) repeating step e) - h) until said percentage amount of light lost to refraction is at least 2%,

j) recording the cloud point temperature of said sample;

k) purging said sample of step j) from said chamber;

l) comparing said recorded cloud point temperature of step j) to a predetermined cloud point temperature;

m) when said recorded cloud point temperature is greater than said predetermined cloud point temperature, adding cloud point depressant to said petroleum fraction source; and

n) repeating steps a) - m) until the recorded cloud point temperature is equal to or less than said predetermined temperature;

wherein said steps a) - n) are performed by a programmable logic controller.

15. A method for automatically depressing the pour point temperature of a petroleum fraction to a tem-

perature equal to or less than a predetermined temperature, said method comprising:

a) removing a petroleum fraction sample from a petroleum fraction source;

b) cooling said sample of step a) in a receptacle (11) having a chamber (24) for holding said sample;.

c) moving a motion indicator means, said motion indicator means at least partially submerged in said sample of step b);

d) detecting said movement of said motion indicator means of step c) with a motion sensing means;

e) repeating steps b) - d) until no movement is detected; and

f) recording said pour point temperature of said sample of step e).

g) heating said sample of step f) until said sample is pourable;

h) purging said sample of step g) from said chamber;

i) comparing said recorded pour point temperature to step f) to a predetermined pour point temperature;

j) when said recorded pour point temperature is greater than said predetermined pour point temperature, adding pour point depressant to said petroleum fraction source; and

k) repeating steps a) - j) until the recorded pour point temperature is equal to or less than said predetermined pour point temperature;

wherein steps a)- k) are performed by a programmable logic controller.

FIG. 1

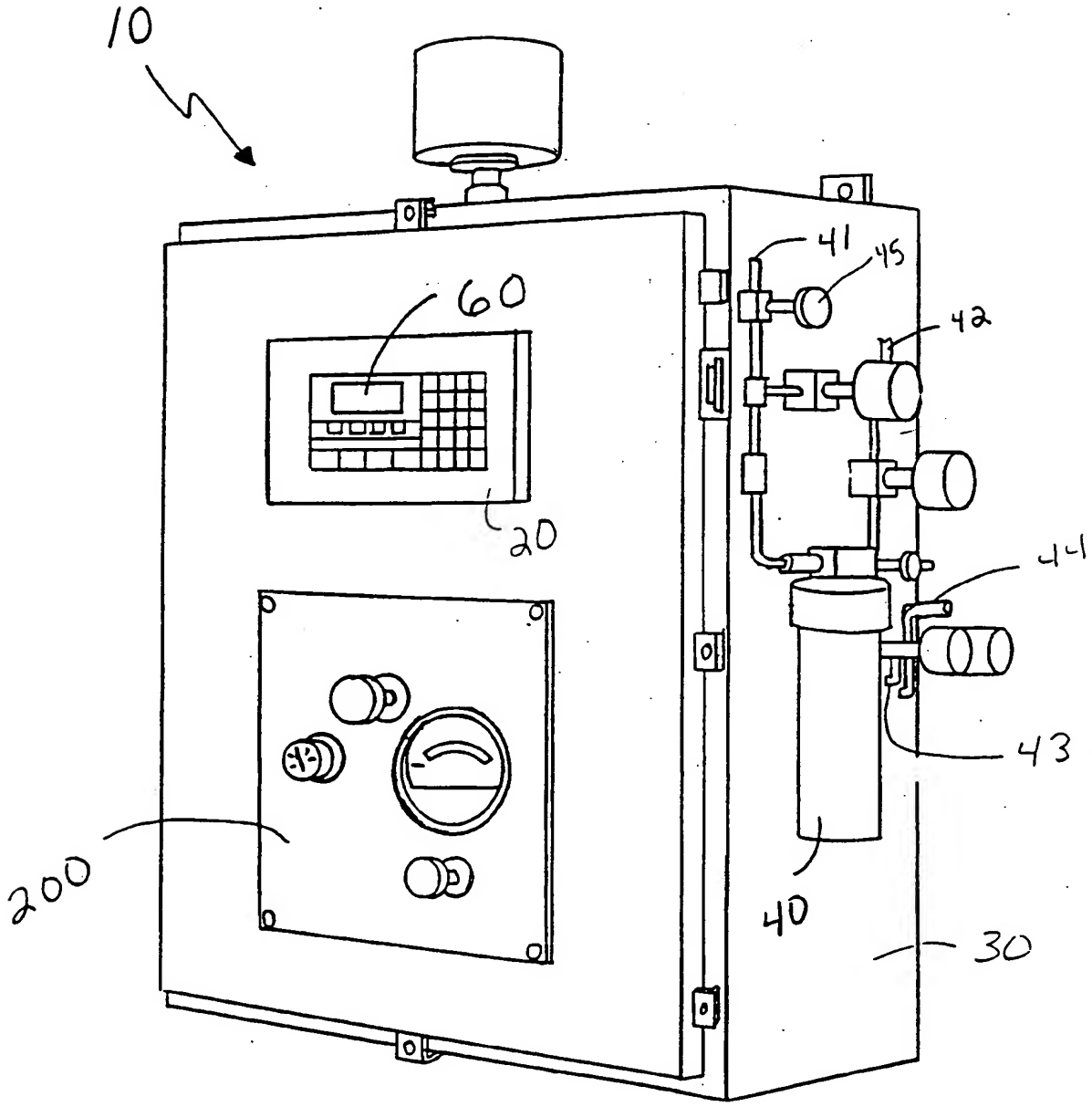

FIG. 2

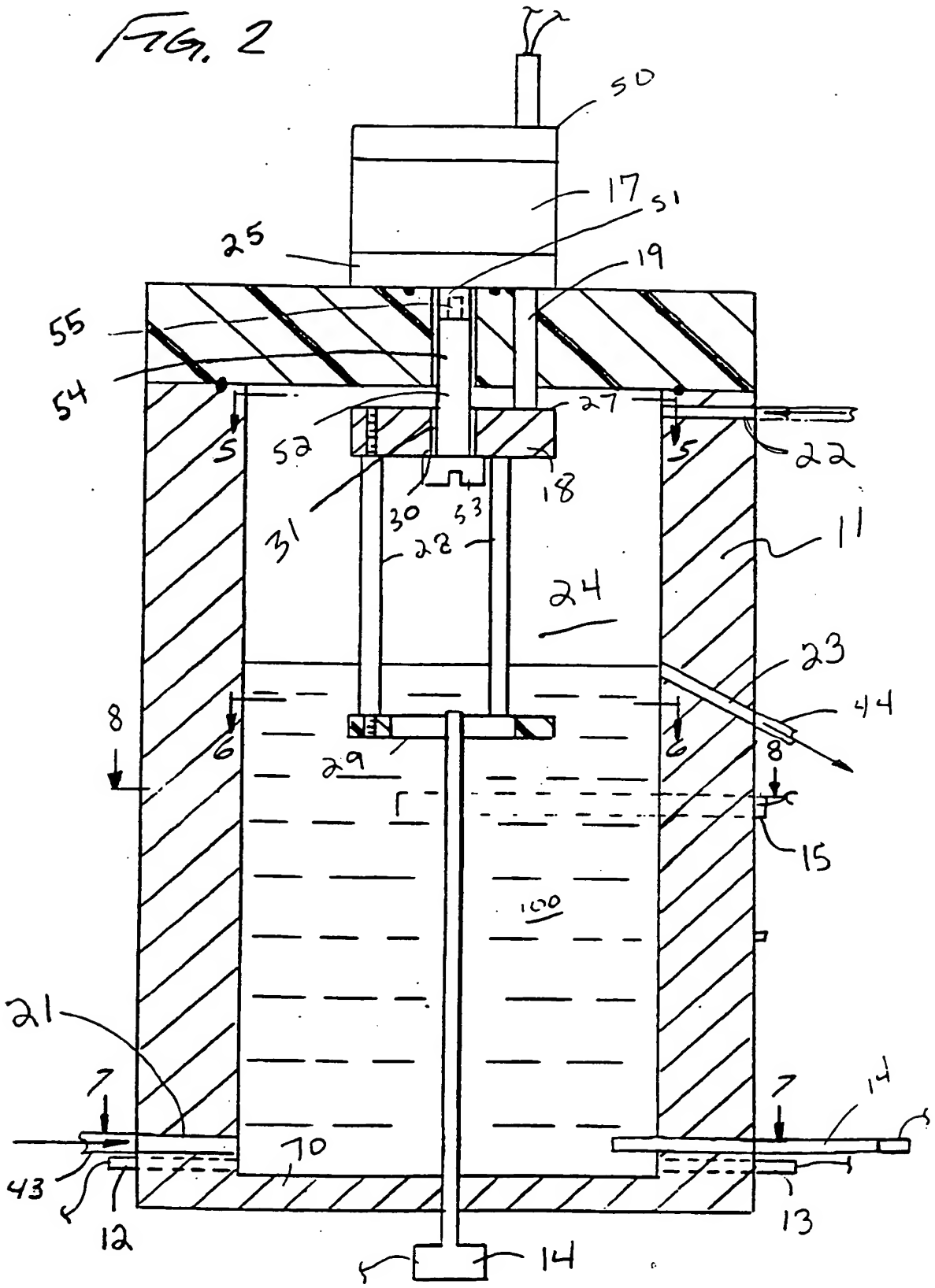
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FIG. 3

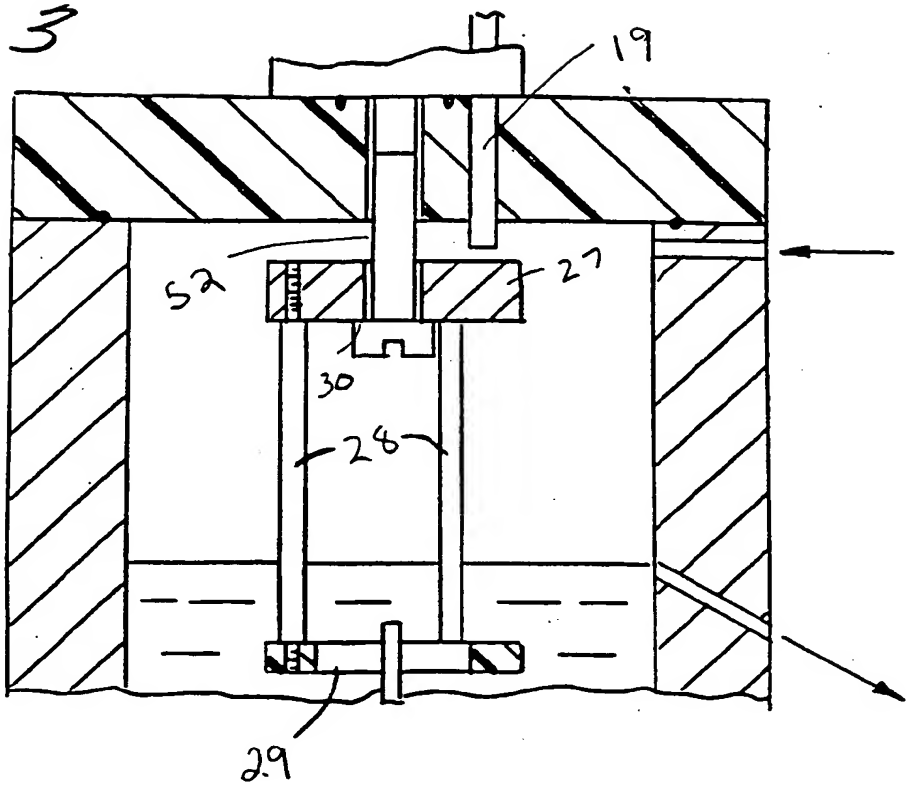


FIG. 4

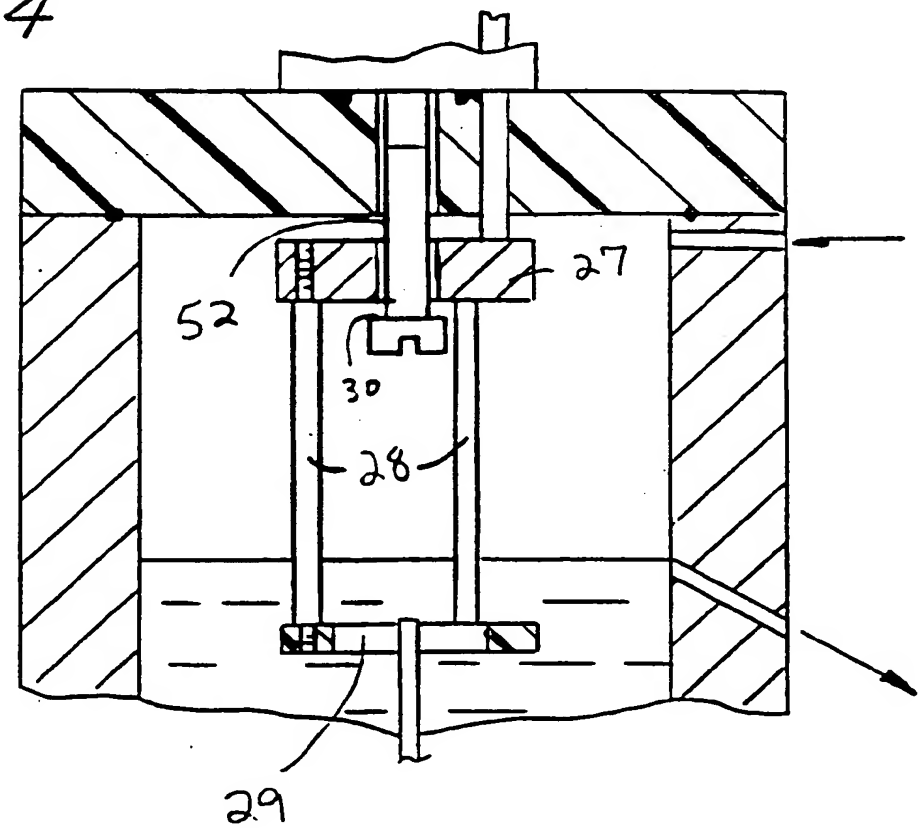


FIG. 5

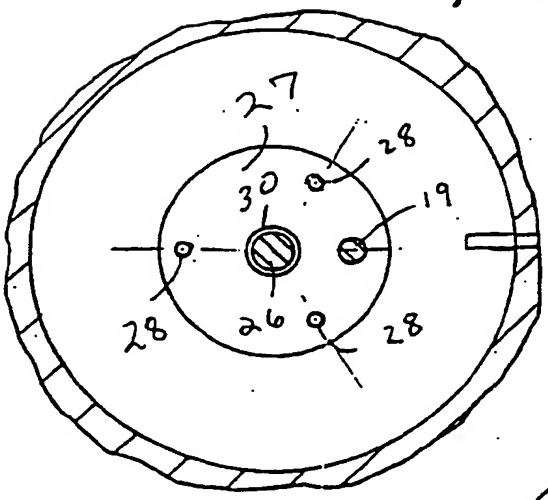


FIG 6

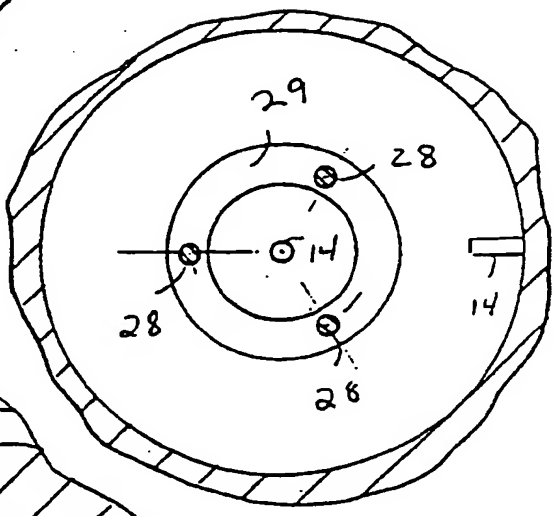


FIG. 7

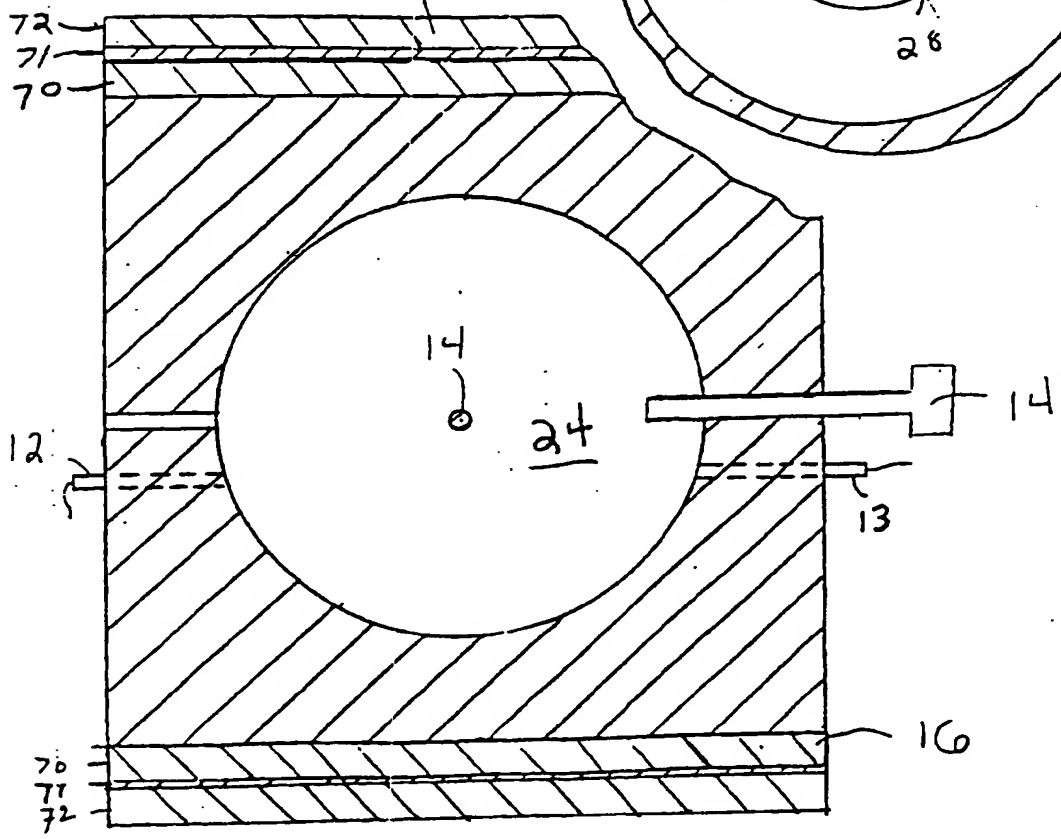
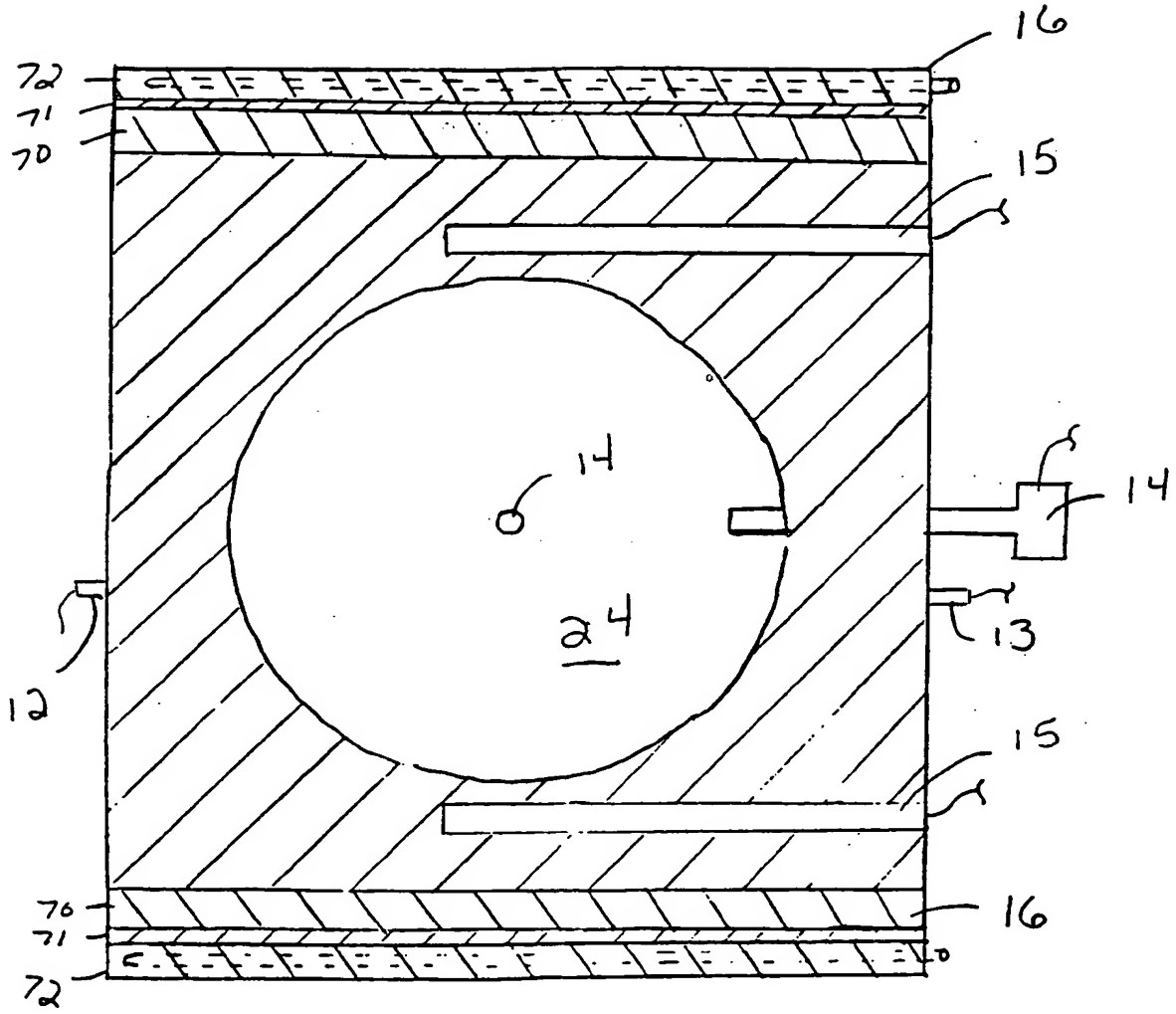


FIG. 8



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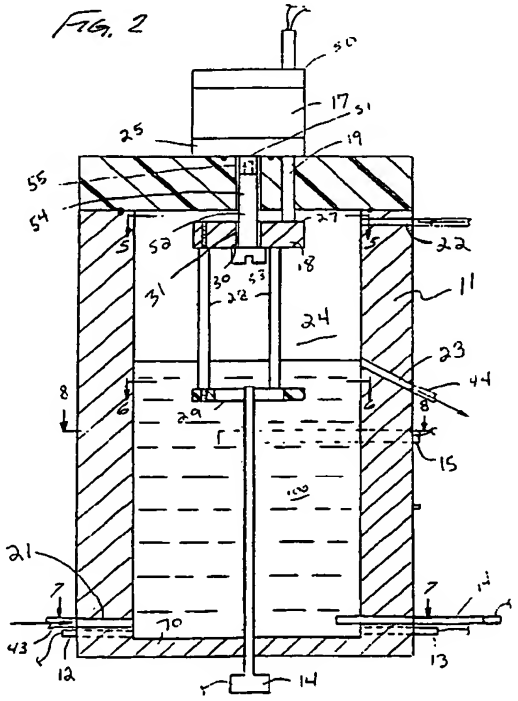
(54) Cloud point and pour point analyser

(57) There is disclosed in preferred embodiments an apparatus and a method for automatic determination of cloud point temperature and pour point temperature of a petroleum fraction. The apparatus is comprised of a receptacle (11) for holding a sample of the petroleum fraction, a light source (12), a light detector (13), heaters (15), coolers (16) and a proximity sensor combined with a motion indicator to determine cloud and pour point temperature. The apparatus preferably has thermocouples to determine the temperature of samples within the container as the sample is heated and cooled. Measurements of light refraction are used to determine cloud point temperature. Detection of the freezing in place of a motion indicator is used to determine pour point temperature. The apparatus is particularly useful for determining the cloud point and pour point temperatures of middle distillate petroleum fuels and the pour point temperature of dark oils and for determining the amount of pour point depressant needed to achieve desired cloud and pour point temperatures in a fuel.



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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 9048

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	PATENT ABSTRACTS OF JAPAN vol. 010, no. 382 (P-529), 20 December 1986 & JP-A-61 173140 (RIGOUSHIYA KK), 4 August 1986,	1-3,6, 12,13	G01N33/28 G01N25/04
Y	* abstract *	5,7-11, 14	
X	US-A-4 677 567 (GROSSER R W ET AL)	15	
Y		7,14	
A	* column 4, line 29 - column 8, line 24; figures 1-4 *	1,6,8,9, 12,13	
Y	EP-A-0 041 458 (COMPAGNIE FRANCAISE DE RAFFINAGE)	5	
A	* page 4, line 5 - page 8, line 9; figure 3 *	1,4,6,8, 12,13	
Y	EP-A-0 533 562 (TOTAL RAFFINAGE DISTRIBUTION)	8	
A	* page 2, line 54 - page 3, line 55; figure 1 *	1,2,6,8, 12,13	
Y	FR-A-2 338 488 (SOCIETE NATIONALE ELF AQUITAINE)	9-11	
A	* page 4, line 17 - page 8, line 24; figures 1,4 *	1-3,8, 12-15	

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TECHNICAL FIELDS SEARCHED (Int.Cl.6)

G01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	20 May 1996	Johnson, K

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 95 30 9048

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 304 233 (BP OIL INTERNATIONAL) * column 3, line 31 - column 5, line 47; figure 1 *	1,2,6-8, 12-15	
A	EP-A-0 098 106 (FRANK & OCKRENT) * page 4, line 1 - page 19, line 8; figures 1,5 *	1,9-12, 15	
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 324 (P-512), 5 November 1986 & JP-A-61 132849 (IDEMITSU KOSAN CO LTD), 20 June 1986, * abstract *	1,6,8, 12,13	

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